

Notice of Allowability

Application No.

09/584,576

Applicant(s)

GRAUMANN, DAVID L.

Examiner

Daniel Swerdlow

Art Unit

2644

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 20 September 2004.
2. ☒ The allowed claim(s) is/are 1-13 and 15-30.
3. ☒ The drawings filed on 31 May 2000 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date _____ |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ms. Lucinda Price, reg. no. 42,270 on 7 December 2004.

The application has been amended as follows:

Amend Claim 1 to read as follows:

1. An echo cancellation unit comprising:
an adaptive filter to generate a current echo model;
a convergence metric computation unit; and
a model store;
wherein the convergence metric computation unit detects an increase in error signal energy due to a data processing or transmission error and in response produces an indication that causes the model store to store the current echo model from the adaptive filter as a saved model before resetting the adaptive filter.

Amend Claim 7 to read as follows:

7. A speakerphone system comprising:
an output device to drive a speaker, the output device being responsive to a reference node coupled to a communications channel;

Art Unit: 2644

an input device responsive to a microphone; and

an echo cancellation unit coupled to the reference node and the input device, such that the echo cancellation unit utilizes data from the reference node to remove echo from a signal received at the microphone;

wherein the echo cancellation unit includes a model store to store a current echo model before resetting the current echo model when an increase in error signal energy due to a data processing or transmission error occurs.

Amend Claim 9 to read as follows:

9. The speakerphone system of claim 7 wherein the echo cancellation unit further includes a real-time error detector to detect when the data processing or transmission error has occurred, and to direct the model store to receive the current echo model, to create a saved model, wherein the system further comprises a FIFO, wherein the data processing or transmission error includes at least one of data interruption, delayed data, lost data, a data timing error, a streaming error, and the FIFO at least one of overruns and underruns.

Amend Claim 13 to read as follows:

13. The speakerphone system of claim 9 wherein echo return loss enhancement is measured by the real time error detector, and wherein the data processing or transmission error is detected when an inversion in echo return loss enhancement occurs abruptly.

Amend Claim 15 to read as follows:

Art Unit: 2644

15. A method comprising:

reconverging an adaptive filter using computer implementation, wherein the reconverging includes:

storing an echo model from the adaptive filter to create a stored model before resetting the adaptive filter when a data timing error occurs;

comparing a current model in the adaptive filter with the stored model, and replacing the current model with the stored model when a match is found within a distance measure;

determining a convergence metric value that describes a level of convergence of the adaptive filter; and

comparing the current model with the stored model when the convergence metric value is above a threshold.

Amend Claim 18 to read as follows:

18. A method comprising:

recognizing an occurrence of a data processing or transmission error; and

reconverging an adaptive filter, wherein recognizing and reconverging include:

detecting the data processing or transmission error;

saving a current echo model in the adaptive filter as a saved model in a model store;

resetting the adaptive filter such that convergence begins anew;

comparing an emerging echo model in the adaptive filter to the saved model; and

replacing the emerging echo model with the saved model when a match is found.

Amend Claim 19 to read as follows:

19. The method of claim 18 wherein detecting the data processing or transmission error comprises:

comparing an adaptive filter output power to an adaptive filter input power; and
when the adaptive filter output power is greater than the adaptive filter input power,
recognizing that the data processing or transmission error has occurred.

Amend Claim 20 to read as follows:

20. The method of claim 18 wherein detecting the data processing or transmission error comprises:

measuring echo return loss enhancement; and
when the echo return loss enhancement inverts, recognizing that the data processing or
transmission error has occurred abruptly.

Amend Claim 24 to read as follows:

24. An article having a machine readable medium with instructions for performing a method of reconverging an adaptive filter disposed thereon, the method comprising:

saving a current echo model from the adaptive filter as a saved model in a model store
when a data processing or transmission error occurs;
resetting the adaptive filter to start converging anew;
comparing an emerging echo model with the saved model; and

Art Unit: 2644

replacing the emerging echo model with the saved model when a match is found.

Amend Claim 26 to read as follows:

26. The article of claim 24 further comprising:

prior to saving a current echo model, determining if the data processing or transmission error has occurred by comparing an adaptive filter output power to an adaptive filter input power.

Amend Claim 27 to read as follows:

27. The echo cancellation unit of claim 1 wherein the data processing or transmission error includes at least one of data loss and delayed data.

The following is an examiner's statement of reasons for allowance:

2. Regarding Claim 1, Karlsen discloses an echo canceller (Fig. 4) comprising: an adaptive filter (Fig. 4, reference 12; p. 7, lines 8-9; p. 5, lines 2-3) that is updated continuously (i.e., generates a current echo model); decision logic (Fig. 4, reference 24; p. 7, lines 13-16) that corresponds to the convergence metric computation unit claimed; and a programmable filter (Fig. 4, reference 18; p. 7, lines 8-16) that corresponds to the model store claimed and into which the adaptive filter can be copied (i.e., store the current echo model from the adaptive filter as a saved model) under control of (i.e., in response to an indication from) the decision logic (Fig. 7, step 730; p. 7, lines 14-16; p. 10, lines 27-30) that corresponds to the convergence metric computation unit claimed. However Karlsen fails to anticipate or fairly suggest a detection of

Art Unit: 2644

increase in error signal energy due to a data processing error and a resultant storage of echo model before resetting an adaptive filter. As such, Claim 1 is allowable.

3. Claims 2 through 6 and 27 are allowable due to dependence from Claim 1.

Regarding Claim 7, Rigstad discloses a speakerphone (Fig. 6: column 11, lines 9-47) comprising: a digital to analog converter (i.e., output device) (Fig. 6, reference 68: "D/A") to drive a speaker (Fig. 6, 32) responsive to a node (Fig. 6, reference 70: summing junction output) that corresponds to the reference node claimed and is coupled to the PSTN (i.e., a communications channel); an analog to digital converter (i.e., input device) (Fig. 6, reference 68: "A/D") responsive to a microphone (Fig. 6, reference 30); an echo cancellation module (i.e., unit) (Fig. 6, reference 268) coupled to the node that corresponds to the reference node claimed and the analog to digital converter that corresponds to the input device claimed to use data from the node that corresponds to the reference node claimed to remove echo from the signal received at the microphone. Karlsen discloses a programmable filter (Fig. 4, reference 18; p. 7, lines 8-16) that corresponds to the model store claimed and receives coefficients from an adaptive filter (i.e., stores a current echo model) when the programmable filter performs poorly (i.e., when a real-time error occurs) (Fig. 7, step 730; p. 11, lines 1-6). It would have been obvious to one skilled in the art at the time of the invention to apply coefficient storing as taught by Karlsen to the speakerphone taught by Rigstad for the purpose of having available a set of coefficients that are known to provide a good quality output signal. However, neither Karlsen nor Rigstad disclose or fairly suggest storing a current echo model before resetting the current echo model when an increase in error signal energy due to a data processing or transmission error occurs. As such, Claim 7 is allowable.

Art Unit: 2644

4. Claims 8 through 13 are allowable due to dependence from Claim 7.

5. Regarding Claim 15, Karlsen discloses comparison between the adaptive filter (i.e., current model) output quality (Fig. 7, step 530, qa) and the programmable filter (i.e., stored model) output quality (Fig. 7, step 530, qp) which, because the filters operate on the same input signal (Fig. 4, reference $x(n)$) constitutes comparing the current model with the stored model; and determination of whether the difference (i.e., distance) exceeds a threshold (i.e., matches a value less than the threshold) (Fig. 7, step 530, B) as part of the determination of whether the programmable filter is copied to the adaptive filter (i.e., replacing the current model with the stored model when a match is found) (Fig. 7, step 760). Further, since the adaptive filter continues to adapt (i.e., converges), copying the programmable filter to the adaptive filter results in reconverging. Karlsen further discloses determining a quality measure (i.e., a convergence metric value that describes a level of convergence) of the adaptive filter (Fig. 7, step 510) and comparing the quality measure of the adaptive filter with the quality measure of the programmable filter (i.e., comparing the current model with the stored model) (Fig. 7, reference 530) when the quality measure of the adaptive filter (i.e., convergence metric) is above a threshold. However, Karlsen fails to anticipate or fairly suggest storing an echo model from the adaptive filter to create a stored model before resetting the adaptive filter when a data timing error occurs. As such, Claim 15 is allowable.

6. Claims 16 and 28 are allowable due to dependence from Claim 15.

7. Regarding Claim 17, Karlsen discloses comparing two echo models (i.e., vectors) by comparing their respective error signals and replica signals (Fig. 5, steps 510, 520). Bergmans discloses representing the difference between vectors as a Euclidean distance (column 5, lines

Art Unit: 2644

62-64). However, there is no teaching or suggestion to apply the concept of Euclidean distance to the comparison in Karlsen. Therefore the claim is allowable.

8. Claims 29 and 30 are allowable due to dependence from Claim 17.

9. Regarding Claim 18, Karlsen discloses: detection of the programmable filter performing more poorly than the adaptive filter (i.e., a real-time error) (Fig. 7, step 530) leading to copying the adaptive filter to the programmable filter (i.e., saving the current echo model as a saved model in a model store) (Fig. 7, step 730); continuously updating the adaptive filter (i.e., resetting the adaptive filter such that convergence begins anew) (p. 5, lines 2-3); comparing the quality of the adaptive filter and the programmable filter (i.e., the emerging model with the saved model) (Fig. 7, step 530); and determination of whether the difference exceeds a threshold (i.e., matches a value less than the threshold) (Fig. 7, step 530, B) as part of the determination of whether the programmable filter is copied to the adaptive filter (i.e., replacing the emerging model with the saved model when a match is found) (Fig. 7, step 760). Further, since the adaptive filter continues to adapt (i.e., converges), replacing the emerging model with the saved model results in reconverging. However, Karlsen fails to anticipate or fairly suggest recognizing and detecting a data processing or transmission error. Therefore the claim is allowable.

10. Claims 19 through 23 are allowable due to dependence from Claim 18.

11. Claim 24 is essentially similar to Claim 18 and is allowable for the same reasons.

12. Claims 25 and 26 are allowable due to dependence from Claim 24.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

Art Unit: 2644


fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel Swerdlow whose telephone number is 703-305-4088. The examiner can normally be reached on Monday through Friday between 8:00 AM and 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forrester Isen can be reached on 703-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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